TEST REPORT
(CLASS II PERMISSIVE CHANGE)

Report Number: 103452439MPK-001
Project Number: G103452439
April 05, 2018

Testing performed on the
Electronic Mortise Lock
Model Number: MX101

FCC ID: 2AKUZPX101C
IC: 22335-PXC101

to

FCC Part 15 Subpart C (15.225)
Industry Canada RSS-210 Issue 9
FCC Part 15, Subpart B
Industry Canada ICES-003

For

Proxess LLC

Test Performed by:	Test Authorized by:
Intertek	Proxess LLC
1365 Adams Court	120 Silver Leaf Way
Menlo Park, CA 94025 USA	Castle Rock, CO 80108 USA

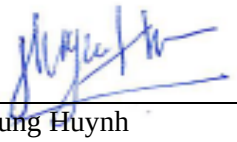
Prepared by: _____ **Date:** April 05, 2018
Hung Huynh

Reviewed by: _____ **Date:** April 05, 2018
Krishna Vemuri

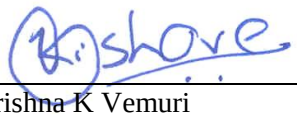
Report No. 103452439MPK-001

Equipment Under Test:	Electronic Mortise Lock
Trade Name:	Proxess LLC
Model Number:	MX101
Serial Number:	MPK1803220853-001
Applicant:	Proxess LLC
Contact:	Mr. Jon Torre
Address:	120 Silver Leaf Way Castle Rock, CO 80108
Country	USA
Tel. Number:	(203) 506-4886
Email	jon.torre@proxess.com
Applicable Regulation:	FCC Part 15 Subpart C (15.225) Industry Canada RSS-210 Issue 9 FCC Part 15, Subpart B Industry Canada ICES-003 Issue 6
Test Site Location:	ITS – Site 1 1365 Adams Drive Menlo Park, CA 94025
Date of Test:	March 22 to March 29, 2018

We attest to the accuracy of this report:



Hung Huynh
Engineer



Krishna K Vemuri
Engineering Team Lead

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1.0 Summary of Tests

TEST	REFERENCE FCC 15.225	REFERENCE RSS-210	RESULTS
Field Strength of Fundamental	15.225(a)	B.6	Complies
Radiated Emissions Outside the band	15.225(b), 15.225(c), 15.225(d), 15.209	B.6	Complies
Frequency Tolerance of the Carrier	15.225(e)	B.6	Complies
Line Conducted Emissions	15.207	RSS-GEN	Not Applicable[2]
Occupied Bandwidth	15.215	RSS-GEN	Complies
Radiated Emissions from Digital Parts	15.109	ICES-003	Complies
Conducted Emissions from Digital Parts	15.107	ICES-003	Not Applicable[2]
Antenna requirement	15.203	RSS-GEN	Complies[1]

[1] EUT utilizes an internal Antenna.
[2] EUT is battery operated.

2.0 General Description

2.1 Product Description

Proxess LLC supplied the following description of the EUT:

The Proxess Electronic Mortise Lock is an RFID enabled Grade 1 mortise lock set that grants access upon correctly reading a 13.56MHz credential. A pin and tumbler lock set is provided as a backup method for entry.

Overview of the EUT

Applicant name & address	Proxess LLC 120 Silver Leaf Way Castle Rock, CO 80108 USA
Contact info / Email	Mr. Jon Torre / jon.torre@proxess.com
Model	MX101
FCC Identifier	2AKUZPX101C
IC Identifier	22335-PXC101
Operating Frequency	13.56MHz
Number of Channels	1
Type of Modulation	ASK
Operating Temperature	-20°C to +50°C
Antenna Type	Internal PCB Antenna

EUT receive date: March 22, 2018
EUT receive condition: The EUT was received in good condition with no apparent damage. As declared by the Applicant it is identical to the production units.
Test start date: March 22, 2018
Test completion date: March 29, 2018

2.2 Related Submittal(s) Grants

None

2.3 Test Methodology

Both AC mains line-conducted and radiated emissions measurements were performed according to the procedures in ANSI C63.4. Radiated tests were performed at an antenna to EUT distance of 10 meters, unless stated otherwise in this test report. All other measurements were made in accordance with the procedures in part 2 of CFR 47 7, ANSI C63.10: 2013, ANSI C63.4-2014& RSS-GEN Issue 4.

2.4 Test Facility

The radiated emission test site and conducted measurement facility used to collect the data is 10m semi-anechoic chamber located in Menlo Park, California. This test facility and site measurement data have been fully placed on file with the FCC and Industry Canada (Site # 2042L-1).

2.5 Measurement Uncertainty

Compliance with the limits was based on the results of the measurements and doesn't take into account the measurement uncertainty.

Estimated Measurement Uncertainty

Measurement	Expanded Uncertainty (k=2)		
	0.15 MHz – 1 GHz	1 GHz – 2.5 GHz	> 2.5 GHz
RF Power and Power Density – antenna conducted	-	0.7 dB	-
Unwanted emissions - antenna conducted	1.1 dB	1.3 dB	1.9 dB
Bandwidth – antenna conducted	-	30 Hz	-

Measurement	Expanded Uncertainty (k=2)		
	0.15 MHz – 30MHz	30 MHz – 1 GHz	1 GHz – 18 GHz
Radiated emissions	-	4.7	5.1 dB
AC mains conducted emissions	2.1 dB	-	-

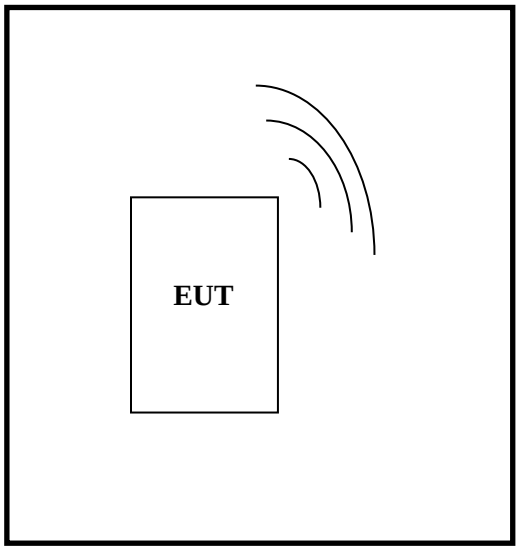
3.0 System Test Configuration

3.1 Support Equipment and description

No System Support Equipment or Cables were used for testing.

3.2 Block Diagram of Test Setup

The diagram shown below details the interconnection of the EUT and support equipment. For specific layout, refer to the test configuration photograph in the relevant section of this report.



S = Shielded **U** = Unshielded	**F** = With Ferrite **m** = Length in Meters

3.3 Justification

For radiated emission measurements the EUT is placed on a non-conductive table. The EUT was configured to continuously transmit and looking for tags. The highest clock frequency used in the EUT is 2.4GHz; Radiated Emissions was tested up to 18GHz for FCC Part 15 Subpart B.

3.4 Software Exercise Program

None

3.5 Mode of Operation during test

The EUT was constantly broadcasting a 13.56 MHz signal. When the EUT recognized a correct 13.56 MHz credential, it would unlock the mortise lock.

3.6 Modifications required for Compliance

Modifications were made by the manufacturer to bring the EUT into compliance for Radiated Emission testing.

Four ferrites were added to cables (Wurth ferrite 742-758-12),

3.7 Additions, deviations and exclusions from standards

No additions, deviations or exclusion have been made from standard.

4.0 Measurement Results

4.1 Field Strength of Fundamental and Radiated Emissions Outside the band

4.1.1 Requirements

FCC Rules 15.225, 15.209

a) The field strength of any emissions within the band 13.553-13.567 MHz shall not exceed 15,848 microvolts/meter (84 dBuV) at 30 meters.

b) Within the bands 13.410-13.553 MHz and 13.567-13.710 MHz, the field strength of any emissions shall not exceed 334 microvolts/meter at 30 meters.

c) Within the bands 13.110-13.410 MHz and 13.710-14.010 MHz the field strength of any emissions shall not exceed 106 microvolts/meter at 30 meters.

d) The field strength of any emissions appearing outside of the 13.110-14.010 MHz band shall not exceed the general radiated emission limits in §15.209.

§15.209 Radiated emission limits; general requirements.

Frequency (MHz)	Field strength (microvolts/meter)	Measurement distance (meters)
0.009-0.490	2400/F(kHz)	300
0.490-1.705	24000/F(kHz)	30
1.705-30.0	30	30
30-88	100	3
88-216	150	3
216-960	200	3
Above 960	500	3

4.1.2 Procedure

Radiated Measurements Below 30 MHz

During the test the EUT is rotated and the measuring antenna angles are varied during the search for maximum signal level.

Radiated emissions are taken at ten meters unless the signal level is too low for measurement at that distance. If necessary, a pre-amplifier is used and/or the test is conducted at a closer distance. Measurements for below 30 MHz were made at 10 meters. Data results below are corrected for distance back to 30 meters.

Radiated Measurements Above 30 MHz

During the test the EUT is rotated and the measuring antenna height and polarization are varied during the search for maximum signal level. The antenna height is varied from 1 to 4 meters.

Radiated emissions are taken at ten meters unless the signal level is too low for measurement at that distance. If necessary, a pre-amplifier is used and/or the test is conducted at a closer distance. Measurements for above 30 MHz were made at 10 meters.

Radiated emission measurements were performed from 9kHz to 1 GHz.
Analyzer resolution is:

200Hz or greater for 9kHz to 150kHz
9 kHz or greater for 150kHz to 30 MHz
120 kHz or greater for 30MHz to 1000 MHz
For those frequencies quasi-peak detector applies

Data includes of the worst-case configuration (the configuration which resulted in the highest emission levels). A sample calculation, configuration photographs and data tables of the emissions are included.

Field Strength Calculation

The field strength is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain (if any) from the measured reading. The basic equation is as follows:

FS = RA + AF + CF – AG – DCF

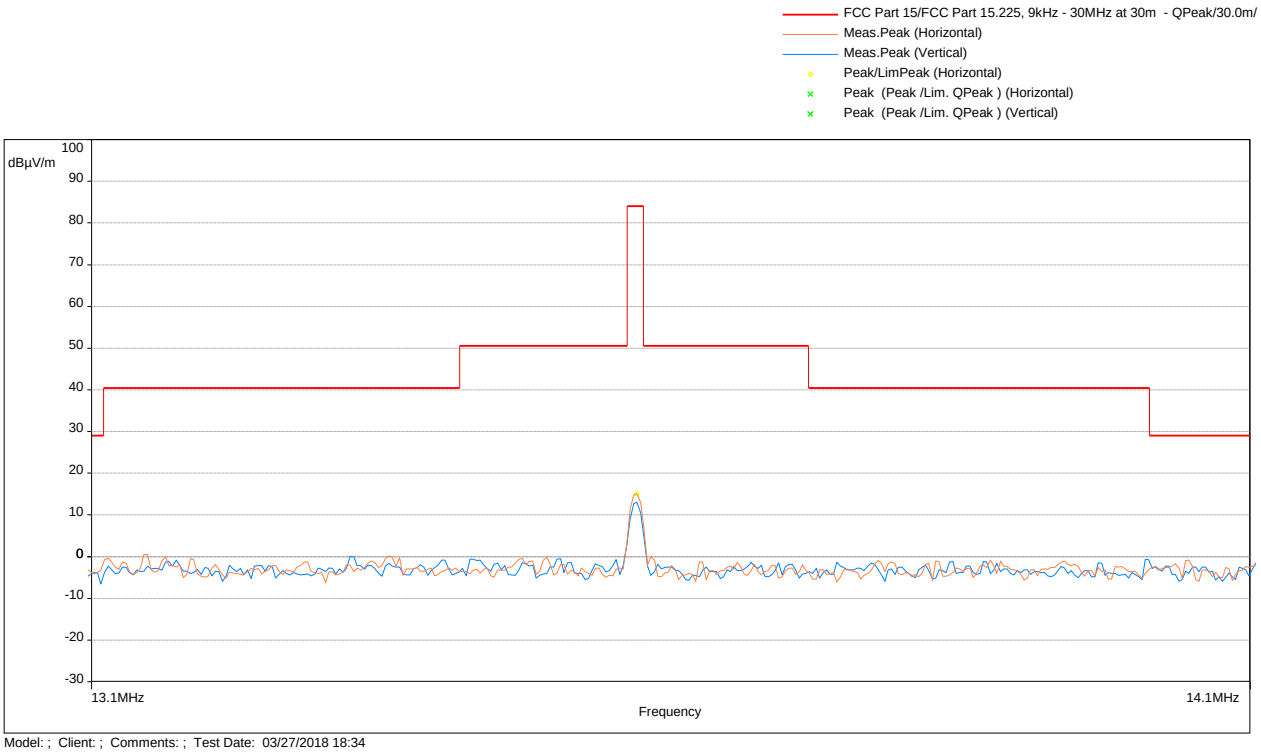
Where FS = Field Strength in dB (μV/m)

RA = Receiver Amplitude (including preamplifier) in dB (μV)
CF = Cable Attenuation Factor in dB
AF = Antenna Factor in dB (1/m)
AG = Amplifier Gain in dB
DCF = Distance Correction Factor

Note: FS was measured with loop antenna below 30MHz

4.1.3 Test Result 15.225 (a)(b)(c)

The data below shows the significant emission frequencies, the limit and the margin of compliance. Note: Measurements were performed at parallel and perpendicular orientation of loop antenna, and vertical and horizontal orientations of EUT. The worst case data was presented below.

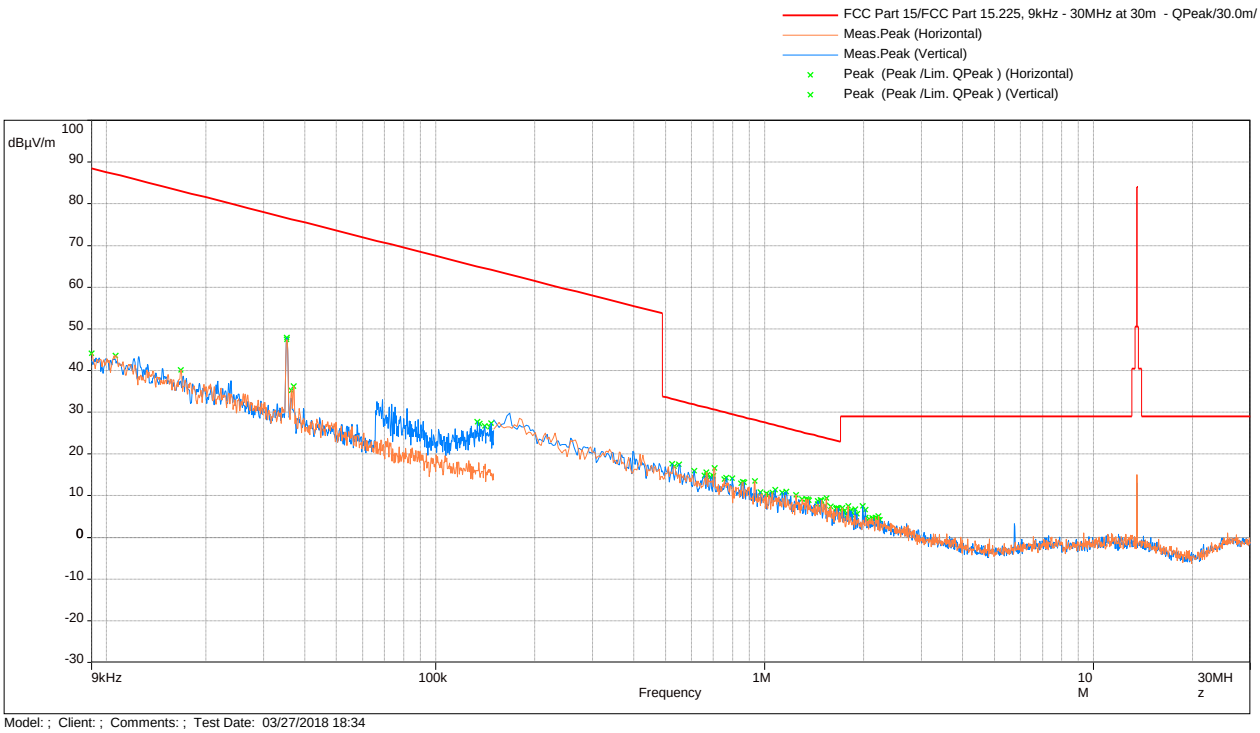


Frequency	Peak FS@30m	Limit@30m	Margin	RA@10m	Correction
(MHz)	dB(uV/m)	dB(uV/m)	dB	dB(uV)	dB
13.56	15.03	84	-68.97	18.16	3.13

Note: Correction = AF+CF–AG–DCF

4.1.4 Test Result 15.225 (d)

Radiated Spurious Emissions from 9 kHz to 30MHz

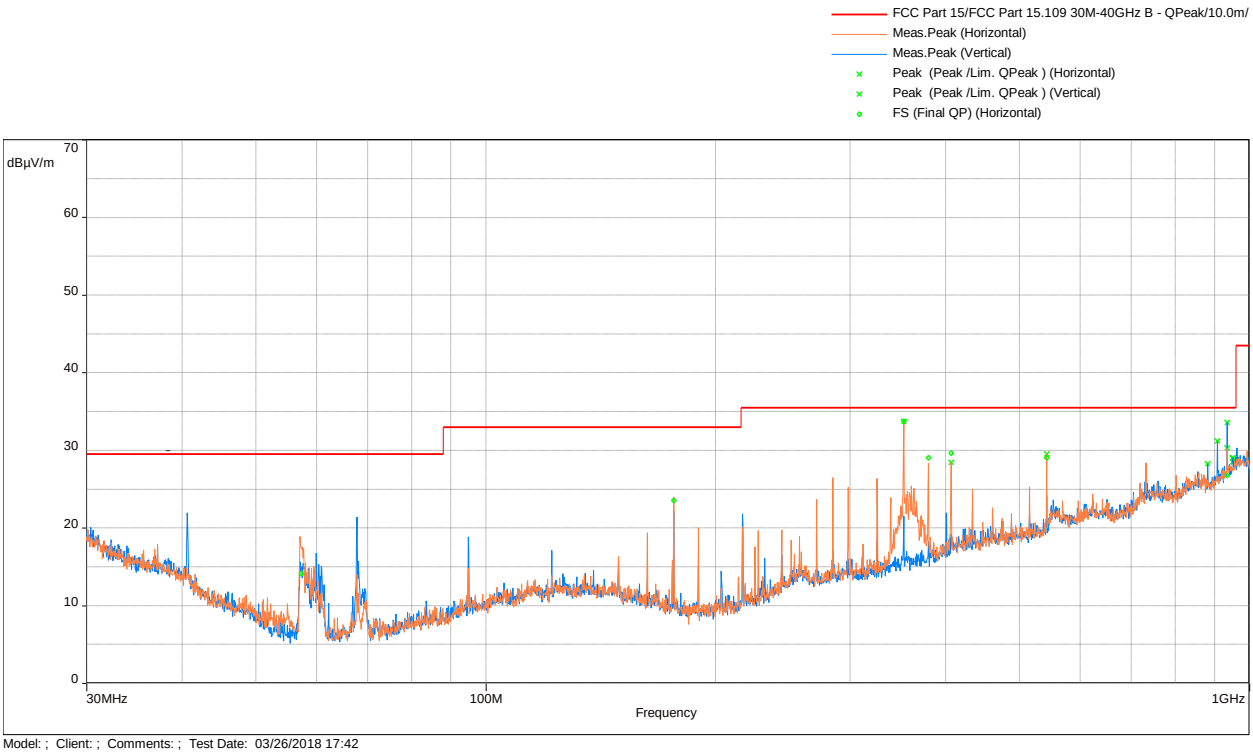


Frequency	Peak FS @30m	Limit@30m	Margin	RA@10m	Correction
(MHz)	dB(uV/m)	dB(uV/m)	dB	dB(uV)	dB
0.035	47.47	76.6	-29.13	66.57	19.1

Note: Correction = AF+CF–AG–DCF

4.1.4 Test Result 15.225 (d) (Continued):

Radiated Spurious Emissions from 30 MHz to 1000 MHz



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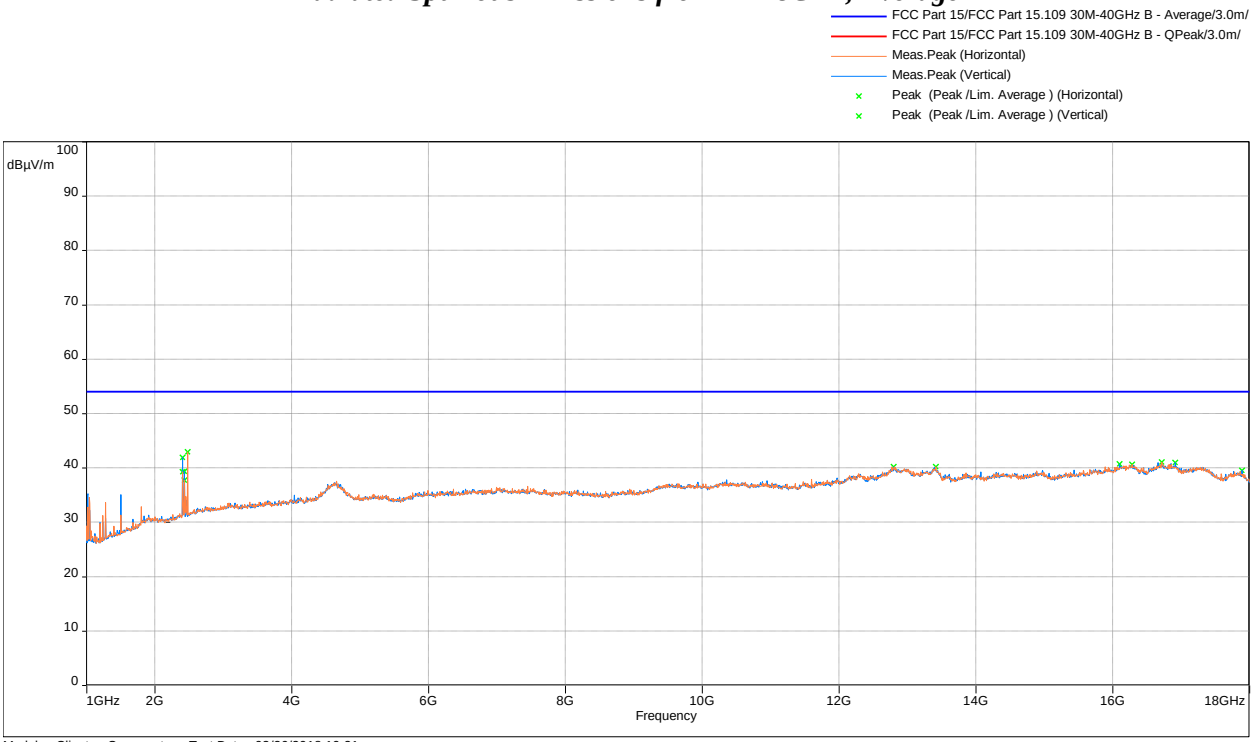
Freq (MHz)	FS @10m (dB(uV/m)	Limit @10m (dB(uV/m)	Margin (dB)	Azimuth (deg)	Height (m)	Polarity	RA @10m (dBuV)	Correction (dB)
57.34665	14.11	29.50	-15.39	191.25	1.16	Horizontal	35.37	-21.29
176.2795	23.54	33.00	-9.46	63.75	4.00	Horizontal	40.36	-16.82
352.5589	33.76	35.50	-1.74	299.50	2.06	Horizontal	44.63	-10.87
379.6805	29.01	35.50	-6.49	94.75	1.87	Horizontal	39.19	-10.18
406.7999	29.61	35.50	-5.89	82.75	2.11	Horizontal	38.59	-8.99
542.3994	29.01	35.50	-6.49	62.25	1.53	Horizontal	35.28	-6.27
935.6374	26.78	35.50	-8.72	157.75	4.00	Horizontal	25.32	1.46

4.1.4 Test Result 15.225 (d) (Continued)

Radiated Spurious Emissions from 1 - 18GHz, Average



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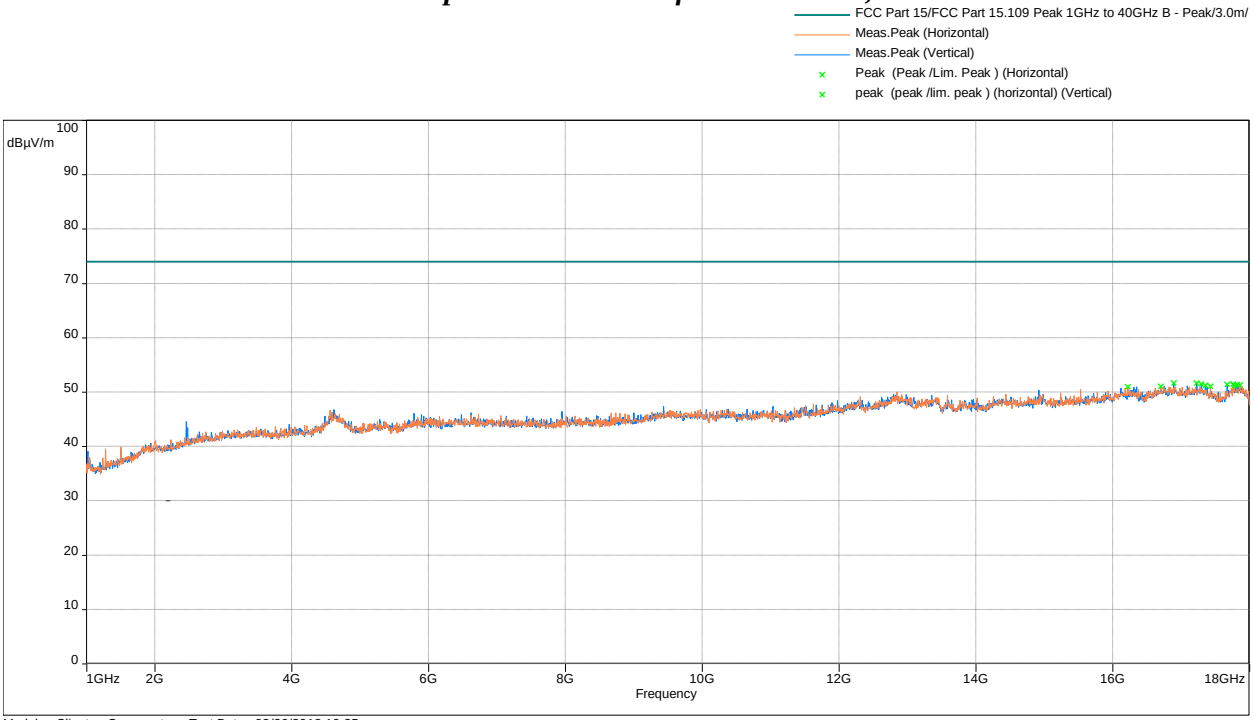
Radiated Spurious Emissions from 1 - 18GHz, Peak



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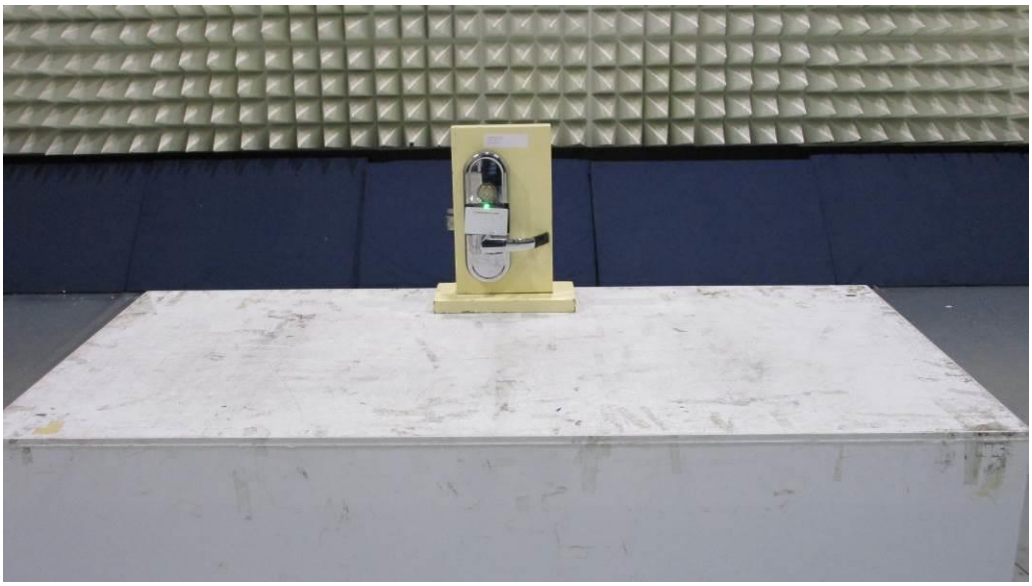
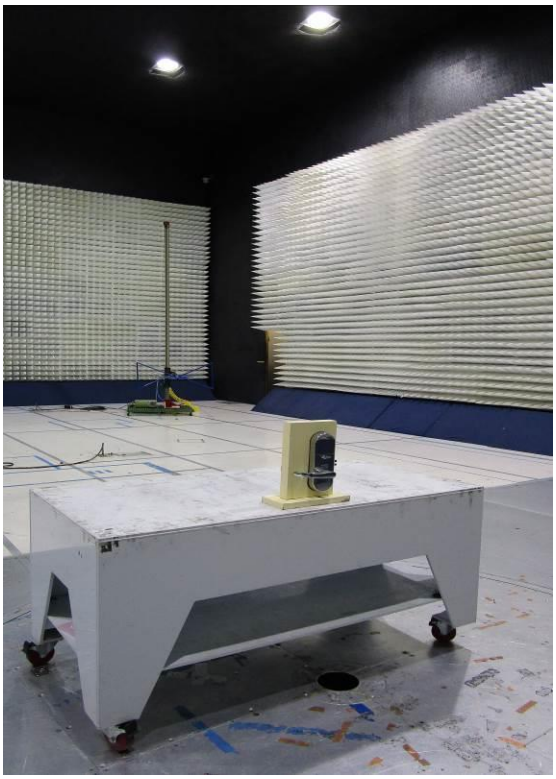
4.1.5 Test Configuration Photographs

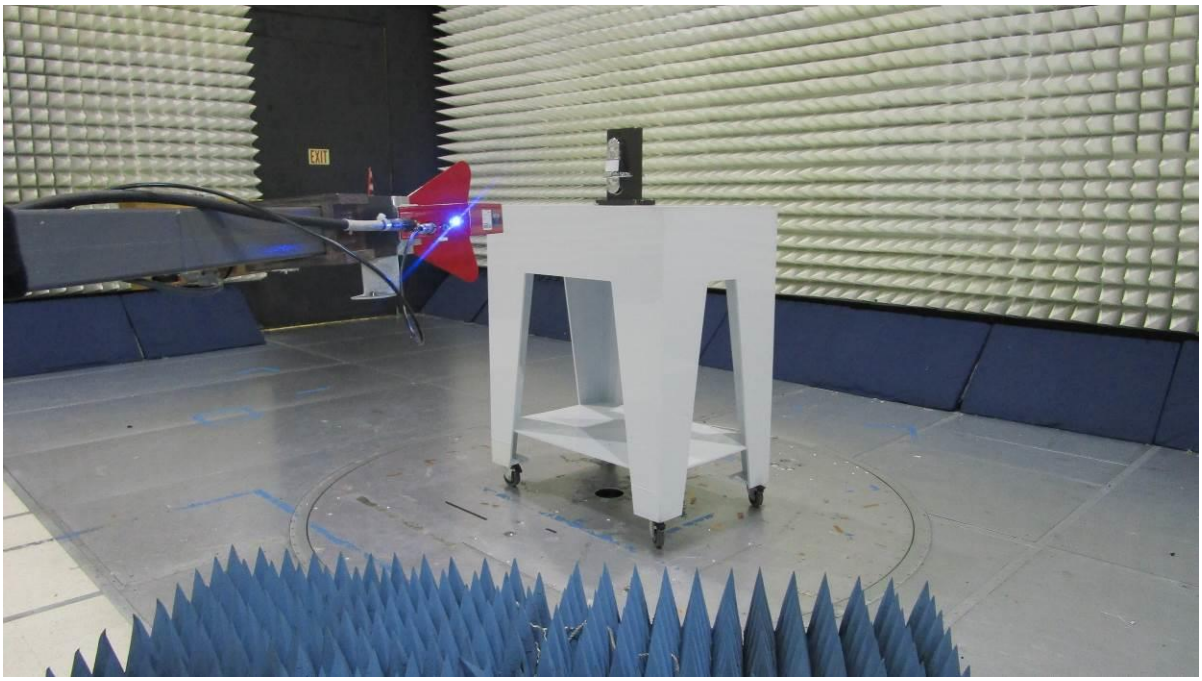
The following photographs show the testing configurations used.





Electromagnetic Radiated Disturbance Setup Photograph

4.1.5 Test Configuration Photographs (Continued)



4.2 Frequency Tolerance

4.2.1 Requirement

FCC 15.225 (e)

The frequency tolerance of the carrier signal shall be maintained within ±0.01% of the operating frequency over a temperature variation of −20 degrees to +50 degrees C at normal supply voltage, and for a variation in the primary supply voltage from 85% to 115% of the rated supply voltage at a temperature of 20 degrees C. For battery operated equipment, the equipment tests shall be performed using a new battery.

4.2.2 Procedure

The EUT was placed in the temperature chamber. The frequency counter was connected to the transmitter output. For each temperature, the carrier frequency was recorded.

4.2.3 Test Results 15.225 (e)

Nominal Frequency: 13560381 Hz

Proxess Electronic Mortise Lock				
Voltage (DC)	**Temperature (C)**	**Measured Frequency (Hz)**	**Deviation from Reference (Hz)**	**Deviation (%)**
3	-20	13560541	160	0.001179
3	-10	13560702	321	0.002367
3	0	13560381	0	0.000000
3	10	13560381	0	0.000000
3	20	13560381	0	0.000000
3	30	13560702	321	0.002367
3	40	13560541	160	0.001179
3	50	13560541	160	0.001179

Nominal Frequency @ 20C, 3VDC: 13560381 Hz

4.3 Occupied Bandwidth
FCC 15.215

4.3.1 Requirements

Intentional radiators operating under the alternative provisions to the general emission limits, as contained in §§15.217 through 15.257, must be designed to ensure that the 20 dB bandwidth of the emission, or whatever bandwidth may otherwise be specified in the specific rule section under which the equipment operates, is contained within the frequency band designated in the rule section under which the equipment is operated. The requirement to contain the designated bandwidth of the emission within the specified frequency band includes the effects from frequency sweeping, frequency hopping and other modulation techniques that may be employed as well as the frequency stability of the transmitter over expected variations in temperature and supply voltage.

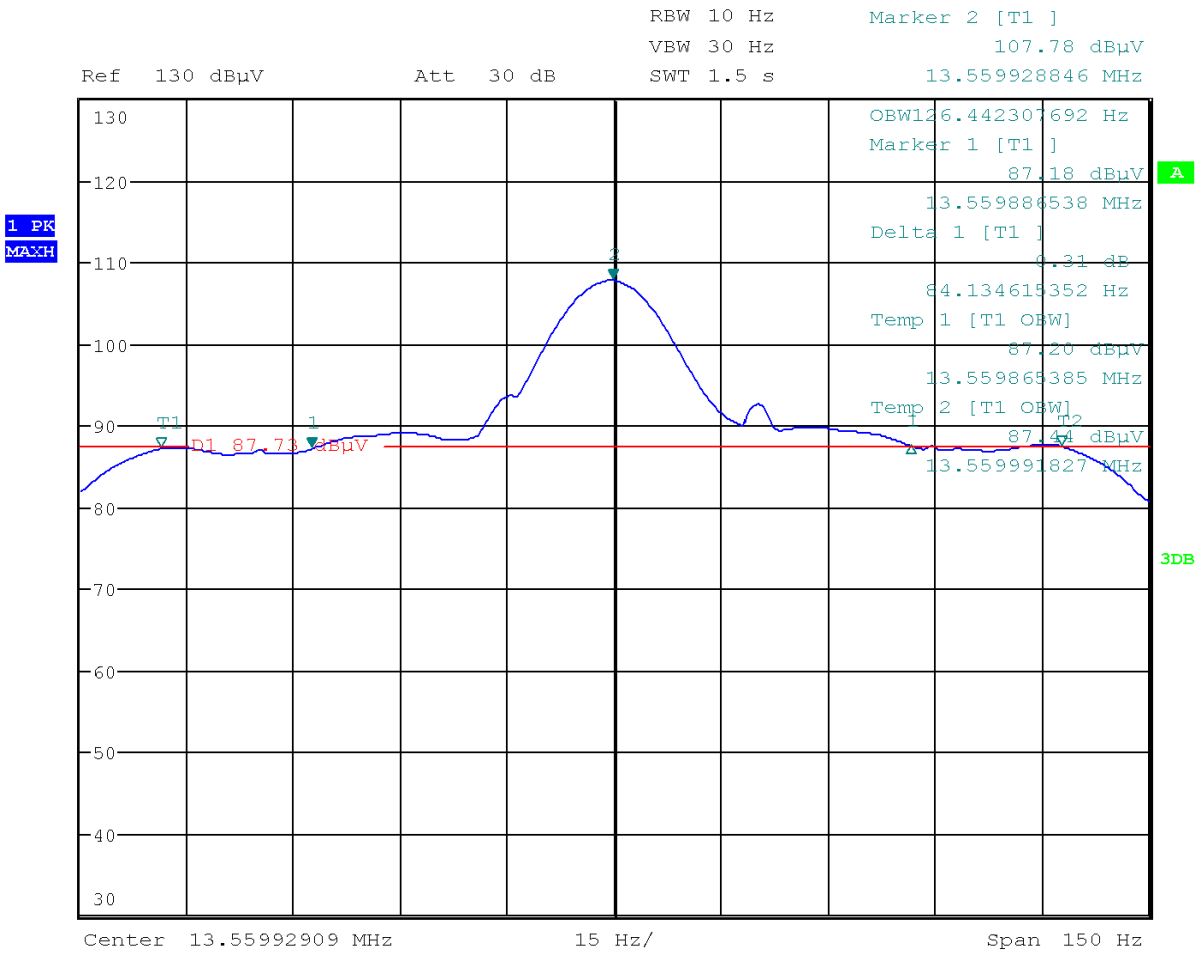
4.3.2 Procedure

The EUT was setup to transmit in normal operating condition.

Measurements were made with the loop antenna in close proximity of the EUT. Following the procedures of ANSI 63.10, the 20dB bandwidth measurements were taken. The following plots show Occupied Bandwidth.

4.3.3 Test Results

EUT	Frequency (MHz)	20-dB Channel Bandwidth (Hz)	99% Channel Bandwidth (Hz)
Proxess Electronic Mortise Lock	13.56	84.1	126.4



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4.4 AC Line Conducted Emission
FCC Rule 15.207, FCC 15.107

4.4.1 Requirement

Frequency Band MHz	Class B Limit dB(μV)		Class A Limit dB(μV)	
	Quasi-Peak	Average	Quasi-Peak	Average
0.15-0.50	66 to 56 *	56 to 46 *	79	66
0.50-5.00	56	46	73	60
5.00-30.00	60	50	73	60

*Note: *Decreases linearly with the logarithm of the frequency. At the transition frequency the lower limit applies.*

4.4.2 Procedure

Measurements are carried out using quasi-peak and average detector receivers in accordance with CISPR 16. An AMN is required to provide a defined impedance at high frequencies across the power feed at the point of measurement of terminal voltage and also to provide isolation of the circuit under test from the ambient noise on the power lines. An AMN as defined in CISPR 16 shall be used.

The EUT is located so that the distance between the boundary of the EUT and the closest surface of the AMN is 0.8m.

Where a flexible mains cord is provided by the manufacturer, this shall be 1m long or if in excess of 1m, the excess cable is folded back and forth as far as possible so as to form a bundle not exceeding 0.4m in length.

The EUT is arranged and connected with cables terminated in accordance with the product specification.

Conducted disturbance is measured between the phase lead and the reference ground, and between the neutral lead and the reference ground. Both measured values are reported.

The EUT, where intended for tabletop use, is placed on a table whose top is 0.8m above the ground plane. A vertical, metal reference plane is placed 0.4m from the EUT. The vertical metal reference-plane is at least 2m by 2m. The EUT shall be kept at least 0.8m from any other metal surface or other ground plane not being part of the EUT. The table is constructed of non-conductive materials. Its dimensions are 1m by 1.5m, but may be extended for larger EUT.

Floor standing EUT are placed on a horizontal metal ground plane and isolated from the ground plane by resting on an insulating material. The metal ground plane extends at least 0.5m beyond the boundaries of the EUT and has minimum dimensions of 2m by 2m.

EUT was placed in transmission mode then tested for conducted emissions per 15.207 to ensure the device complies with 15.207 outside the transmitter fundamental emissions band. After, the EUT antenna is removed from the EUT and only the fundamental emission band was measured to show that the fundamental emission band is in compliance with the 15.207 limits.

Equipment setup for conducted disturbance tests followed.

4.4.3 Test Result

Not Applicable. EUT is Battery powered only.

4.5 Radiated Emissions on Digital Parts and Receiver

FCC Ref: 15.109, ICES 003, RSS Gen

4.5.1 Test Limit

Limits for Electromagnetic Radiated Emissions FCC Section 15.109(b), ICES 003*, RSS GEN

Frequency (MHz)	Class A at 10m dB(μV/m)	Class B at 3m dB(μV/m)
30-88	39	40.0
88-216	43.5	43.5
216-960	46.4	46.0
Above 960	49.5	54.0

* According to FCC Part 15.109(g) an alternative to the radiated emission limits shown above, digital devices may be shown to comply with the limit of CISPR Pub. 22

4.5.2 Procedures

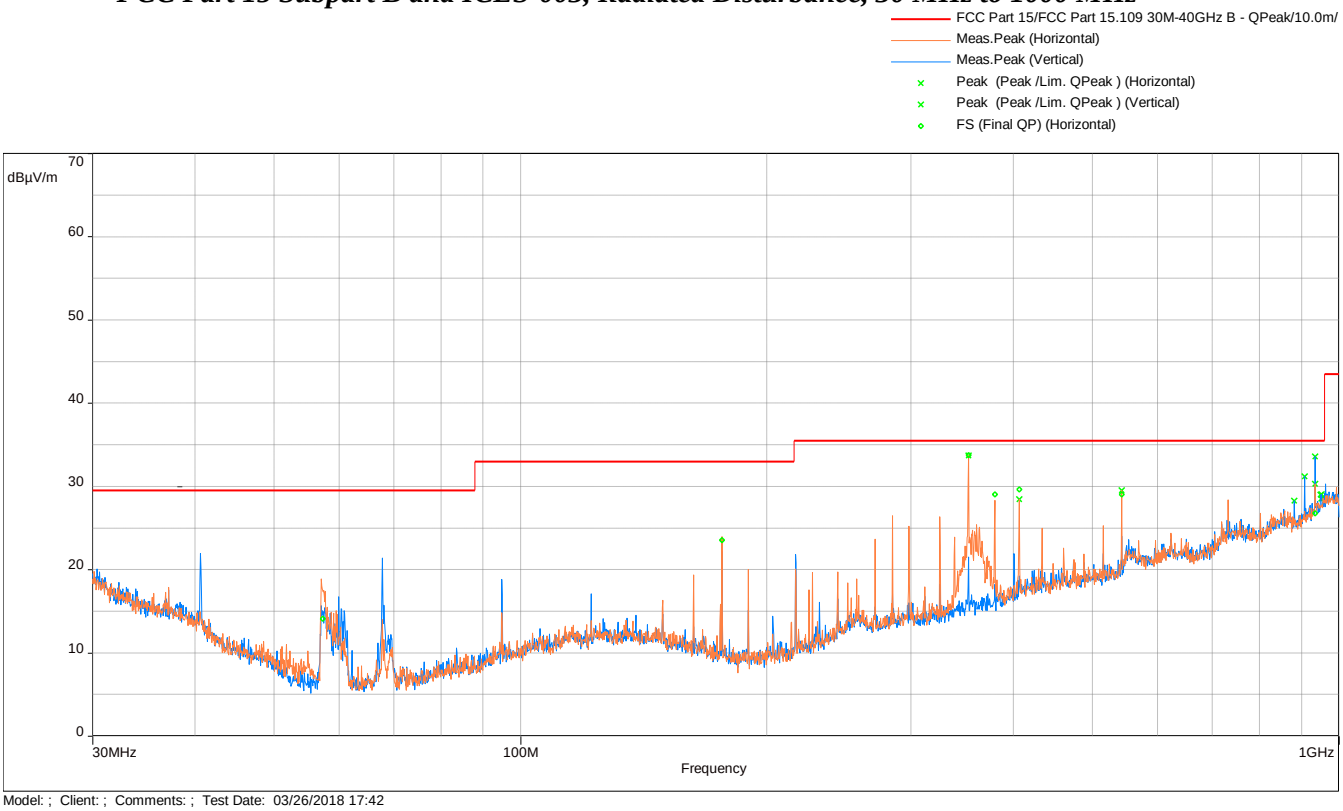
Radiated measurements were taken. 120 kHz resolution bandwidth was used from 30 MHz - 1 GHz. 1 MHz resolution bandwidth was used for measurements done above 1 GHz. All plots are corrected for cable loss, antenna factor, and preamp.

4.5.3 Test Results

Radiated emission measurements were performed from 30 MHz to 18000 MHz. The data on the following pages list the significant emission frequencies, the limit and the margin of compliance.

4.5.3 Test Results

FCC Part 15 Subpart B and ICES-003, Radiated Disturbance, 30 MHz to 1000 MHz



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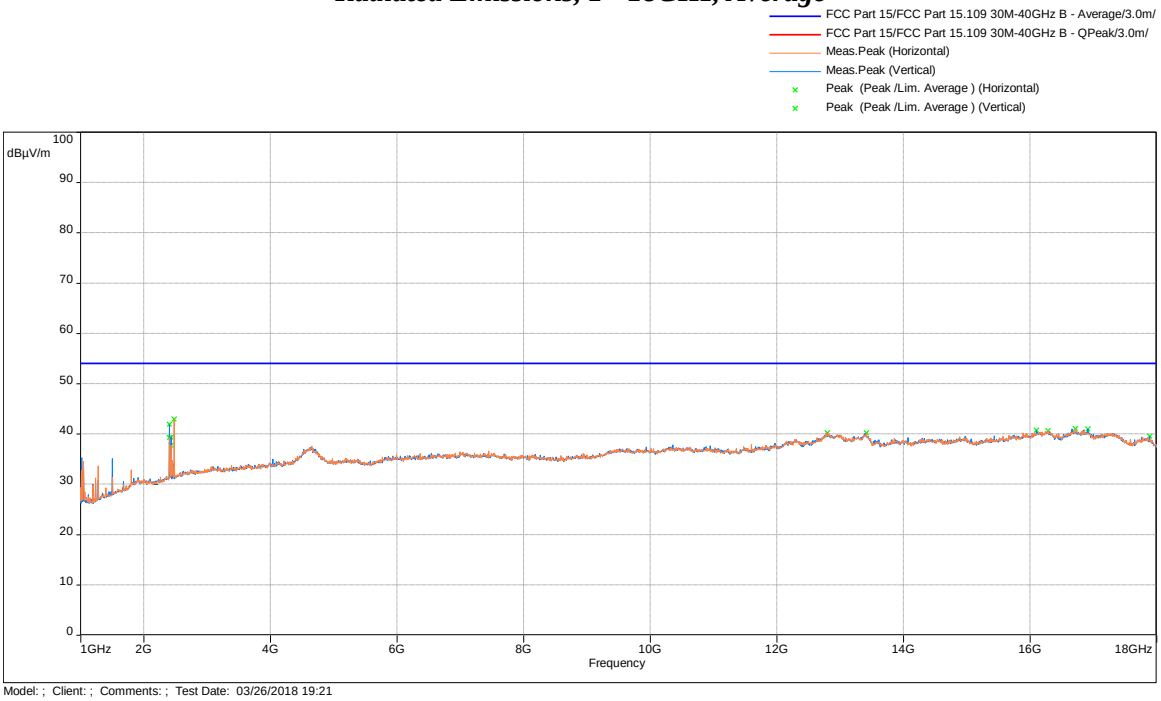
Freq (MHz)	FS @10m (dB(uV/m))	Limit @10m (dB(uV/m))	Margin (dB)	Azimuth (deg)	Height (m)	Polarity	RA (dBuV)	Correction (dB)
57.34665	14.11	29.50	-15.39	191.25	1.16	Horizontal	35.37	-21.29
176.2795	23.54	33.00	-9.46	63.75	4.00	Horizontal	40.36	-16.82
352.5589	33.76	35.50	-1.74	299.50	2.06	Horizontal	44.63	-10.87
379.6805	29.01	35.50	-6.49	94.75	1.87	Horizontal	39.19	-10.18
406.7999	29.61	35.50	-5.89	82.75	2.11	Horizontal	38.59	-8.99
542.3994	29.01	35.50	-6.49	62.25	1.53	Horizontal	35.28	-6.27
935.6374	26.78	35.50	-8.72	157.75	4.00	Horizontal	25.32	1.46

4.5.3 Test Results (Continued)

Radiated Emissions, 1 - 18GHz, Average



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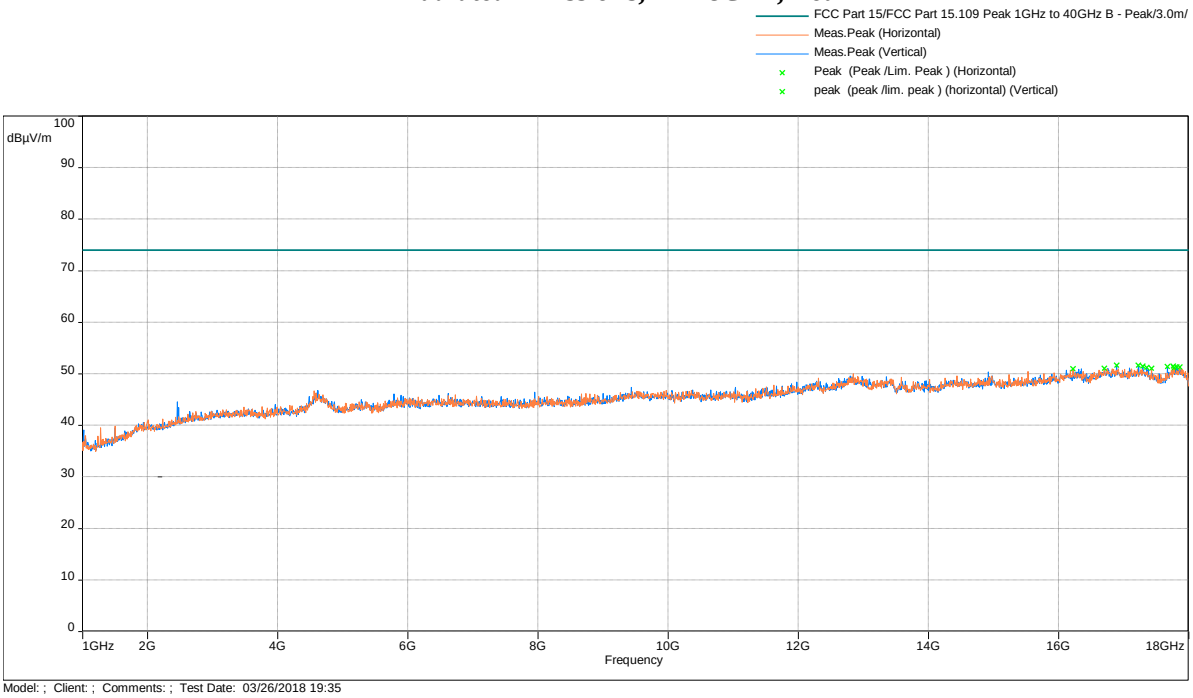
Radiated Emissions, 1 - 18GHz, Peak



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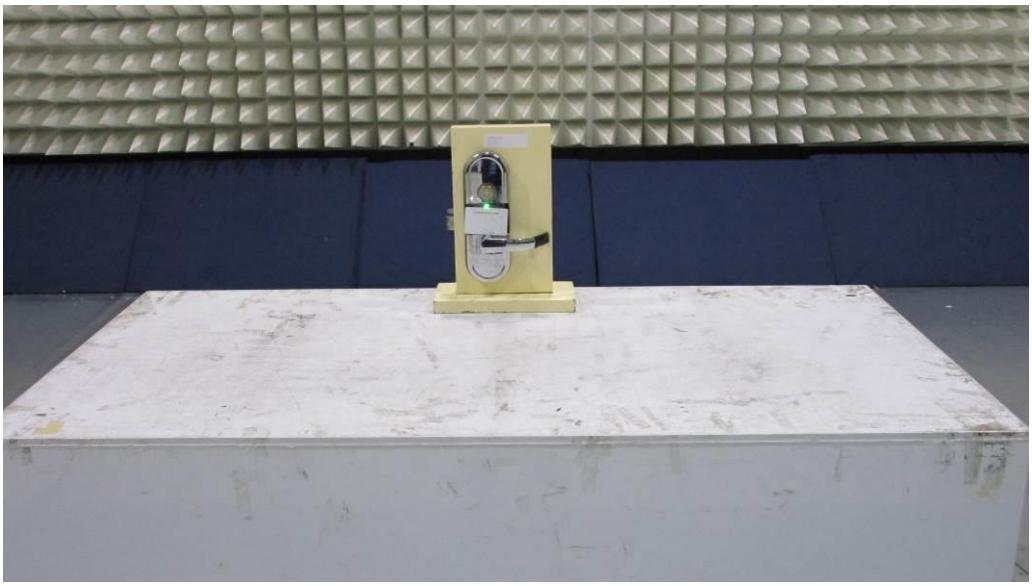
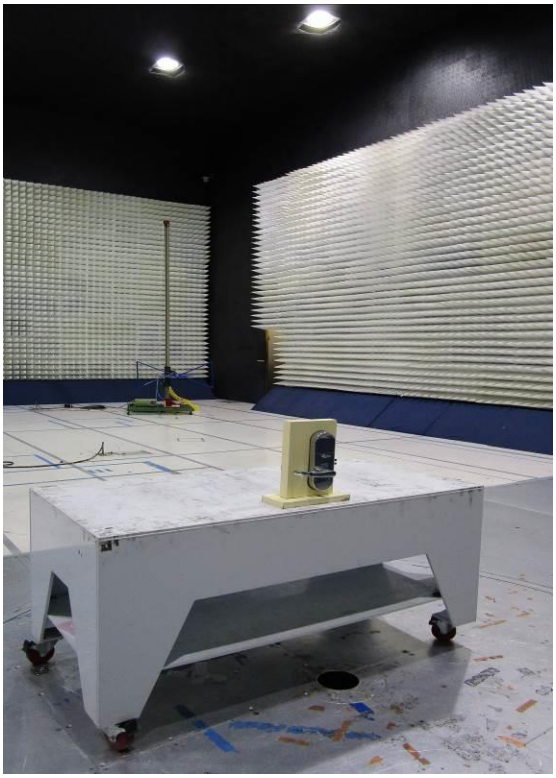
Result	**Complies** by 1.74dB to FCC Part 15, Subpart B

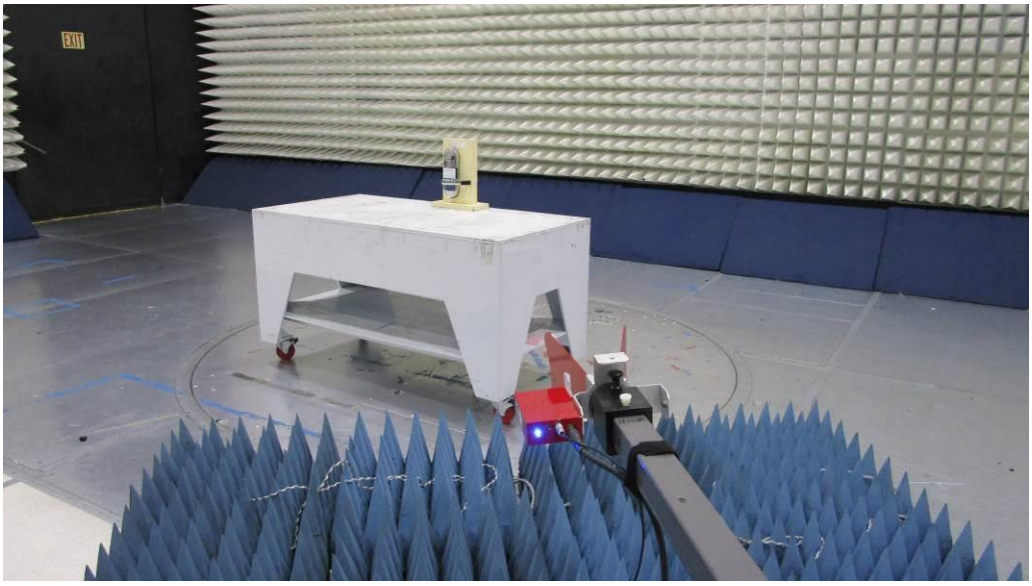
4.5.4 Test Configuration Photographs





Electromagnetic Radiated Disturbance Setup Photograph

4.5.4 Test Configuration Photographs (Continued)



5.0 List of test equipment

Measurement equipment used for emission compliance testing utilized the equipment on the following list:

Equipment	Manufacturer	Model/Type	Asset No.	Calibration Interval	Cal Due
EMI Receiver	Rohde and Schwarz	ESU	ITS 00961	12	07/10/18
BI-Log Antenna	Schaffner	CBL 6112B	ITS 211386	12	05/05/18
Pre-Amplifier	Sonoma Instrument	310	ITS 00942	12	01/26/19
Horn Antenna	ETS Lindgren	3117-PA	ITS 01365	12	08/21/18
Environmental Test Chamber	ESPEC	BTX-475	ITS 01436	12	09/14/18
Loop Sensor	Solar Electronics	7334-1	ITS 001608	12	09/26/18
Ant-Passive Loop	EMCO	6512	ITS 001598	12	10/10/18

Software used for emission compliance testing utilized the following:

Name	Manufacturer	Version	Template/Profile
BAT-EMC	Nexio	3.17.0.10	Proxess 3-21-18.bpp

6.0 Document History

Revision/ Job Number	Writer Initials	Reviewer Initials	Date	Change
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